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Semi-Arid Food Grain Research and Development
Recherche et Developpement des Cultures Vivrières dans les Zones Semi-Arides

CURRENT STATUS OF THE FOOD GRAIN COLLABORATIVE RESEARCH NETWORKS

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ACCOMPLISHMENTS AND SCOPE OF ACTIVITIES

Global constraints to the production of sorghum in West and Central Africa were collated during the 1985/86 workshops. Researchers in Eastern Africa did also identify the major constraints to sorghum and millet production during the 1986 regional workshop. Similarly, the maize and cowpea researchers of the West and Central African region documented the major problems affecting the production of these crops during their 1987 workshop. The similarity of food production constraints convinced participating NARS to create collaborative research networks by mobilizing scientific talents and resources of member countries. Food production problems transcend linguistic and cultural barriers as well as political frontiers. The collaborative mode has been adopted to facilitate large exchange and joint evaluation of technologies in different ecological zones. Taking into account the different levels of NARS research capabilities, the collaborative research networks programmes did orient activities to both technology adapting and generating NARS.

A comparative advantage has been realized by pooling research resources together with relatively, strong and weak national research programmes as well as those of the IARCs in alleviating common constraints to food production in the region. For example, a particular national programme alone could not afford to resolve the problems of streak virus, striga, insects and disease on different crops. Furthermore, technology adapting NARS were assisted through consultation visits from network coordinators and senior members of the respective steering committees. Coordinators have also arranged special research support from IARCs to NARS as reported elsewhere.

The importance of food grain the focus of SAFGRAD research networks impetus are indicated in Table 1 and 2.

Table 1. Importance of SAFGRAD Mandated Crops (West and Central Africa)

Crops	Sahel Savanna (300-600 mm/year)	Sudan Savanna (600-850 mm/year)	Northern Guinea Savanna (850-1200 mm/year)
Sorghum	x	xxx	xx
Maize		xx	xxx
Millet	xxx	xx	
Cowpea	xxx	xxx	x
Groundnut	x	xxx	xx

Table 2 Importance of SAFGRAD Mandated Crops In Eastern Africa

Crops	Highland (Elevation Above 1800 m)	Intermediate (Elevation 1500-1800 m)	Lowland (Elevation below 1400 m)
Sorghum	xx	xxx	xxx
Maize	xxx	xxx	xxx
Pearl Millet		xx	xxx
Finger Millet	x	xx	xx
Cowpea		xx	x

xxx The major crop cultivated in the region

xx Indicates moderate cultivation of the crop in the region

x Indicates slight production of the crop in the region

I. TECHNOLOGY EXCHANGE AND DEVELOPMENT

1.0 West and Central African Collaborative Maize Research Networks

Maize is an important staple food crop in Sub-Saharan Africa and it is cultivated on approximately eleven million hectares. Maize improvement within the SAFGRAD collaborative research activities is aimed at the development of superior open pollinated varieties suitable for the Northern Guinea and Sudan Savanna zones (700 - 1100 mm) mainly early and extra-early maturing varieties.

Between 1979 to 1985 growing season 192 sets of intermediate maturing uniform regional trials (95-110 days known as RUVT-1)were evaluated. Over 171 sets of early maize maturing (80-95 days known as RUVT-2) group were evaluated by different NARS. A total of 44 maize varieties in the intermediate maturing group and 42 varieties in early maturing group were also evaluated during the same period. Since 1986 the thrust of maize improvement through the collaborative research networks has also been on the development of extra - early (70-80 days). The regional trials of SAFGRAD network emphasizes the development of early maturing maize cultivars.

The above mentioned three maturity groups of maize germplasm enabled NARS to identify suitable varieties for small farmers in their respective countries.

The maize network has been found to have contributed immensely to forging closer contacts and exchange of technical information and materials between the participating National Agricultural Research Institute through the participating scientists of NARS (National Agricultural Research System).

From the Regional Varietal Trials, genetic materials have been identified as parents in breeding programmes. Cultivars like Across 86 Pool 16 DR, 43 SR, 49 SR, DMR-ESR-Y and extra-early maize materials have been identified for potential release in participating countries. Varieties of some countries have been taken to other countries for cultivation. In the Cameroon, Mexican 17 has been the recommended maize variety before the

maize network was established, but is now being replaced by DMR-ESR-Y which was identified through the activities of SAFGRAD Maize Network. In Nigeria, the extra-early maize regional trials of the Network is being identified as an avenue to expanding maize cultivation to new areas where short wet season duration has precluded cultivation and/or achievement of sustainable yields. From the International Agricultural Center (IARC) it is evident that the Streak resistance technology developed at IITA has been transferred to the NARS of Togo through the activities of the SAFGRAD Maize Network.

It is of general view that the monitoring tours organized by the Network have contributed to improvement of research programmes of some of the countries visited through expert advise on how such programmes could be reoriented to better achieve national objectives.

Substantial agronomic work has been done with regard to the improvement of maize production in the typical soils (i.e alfisols and inceptisols) of the region which have various constraints. These include poor fertility of the soil due to low levels of nitrogen and phosphorous ; the risks of drought stress in the region is often high due to erratic rainfall distribution patterns ; the consequences due to compacting and crusting characteristics of these soils are surface sealing with lower water infiltration rates and increased run-off losses. Various types of soil and water conservation technologies were identified. These technologies would be evaluated for broader adaption by farmers. For example, tied ridges (a technology extensively tested through the SAFGRAD project) have improved water infiltration and improved substantially maize and sorghum yields.

SAFGRAD phase II maize improvement programme is based on major production constraints (i.e striga, drought, streak disease etc). Major emphasis has been on the development of early and extra early maturing groups.

Given the period of less than three years that the SAFGRAD Maize network has been in existence not much could be said to have been achieved in the area of technology adoption by farmers. Nevertheless agronomists are presently formulating technology adoption studies and it is premature to evaluate the contributions of the network in this area.

Collaborative Research Projects

Tha major thrust of the maize network collaborative efforts is to enhance the development of early and extra-early maturing cultivars of maize suitable to the West African Semi-Arid tropics. Although IITA and CIMMYT provide the basic germplasm, this program is unique in that, it is the only one in the region that develop maize cultivars prone to drought and related stresses. To fill this research gap (generation of extra-early and early maturing group of maize), the network has continued to strengthen its resident collaborative research in cooperation with the National Program of Burkina Faso. At the other lead NARS, progress has been made in the screening various maize cultivars to withstand various biotic and abiotic stresses i.e drought, striga, streak, stemborer, storage problem, agronomic practices including soil-water management and the improvement of the utilization of maize.

2.0 WEST AND CENTRAL AFRICAN SORGHUM RESEARCH NETWORK (WCASRN)

Sorghum is an important cereal cultivated on an over nine million ha. The SAFGRAD and ICRISAT cooperative research programs main thrust has been to enhance the improvement of sorghum and millet in different NARS. Since its establishment the West and Central African Sorghum Research Network has been in the development of cultivars that resist to various biotic and physical stresses (i.e drought, striga, low soil fertility, grain molds, leaf diseases, insect pests). Through ICRISAT/SAFGRAD collaborative research support, few sorghum varieties were found promising in different NARS. Some of the varieties of sorghum were extensively evaluated in farmers fields and are also being cultivated by farmers (to some extent). These varieties are Framida, E35-31, IC SV 16-5 BF, ICSV 1049 BF, were found suitable in Burkina Faso. The varieties S-35 and S-34 are also grown by farmers in Cameroon.

The variety ICSV 1007 BF was found promising in Niger, Nigeria and Togo. After WCASRN was formalized, it has organized three types of regional trials i.e for eraly medium maturing sorghums and the sorghum hybrid trials. A number of varieties were promising in different participating NARS.

After intensive testing in regional trials the Network Steering Committee recommended three early varieties (ICSV 1083, CE 180-33 and ICSV 111) and three medium maturity varieties (ICSV 1063, ICSV 1089 and MaliSor 84-1) for large scale multiplication with farmers.

Collaborative Research Projects

Despite that lead NARS were identified to undertake collaborative research activities in specific stress factors that they have accepted responsibility, only the programs in Burkina Faso on leaf anthracnose; Mali, on head bugs; Niger, on long smut; and in Nigeria on industrial use were started in 1988/89. These collaborative research activities have continued. The steering committee of WCASRN at its sixth meeting also recommended to intensify research efforts in the area of agronomy.

3. EASTERN AFRICA REGIONAL SORGHUM AND MILLET RESEARCH (EARSAM)

The SAFGRAD Eastern Africa Regional Sorghum and millet network (EARSAM) includes eight countries (Burundi, Ethiopia, Kenya, Rwanda, Tanzania, Somalia, Sudan and Uganda). The total population of these countries approximates 130 million inhabitants with the highest rate of growth in the continent. Although there is growing concern to curb population growth in this region, the process of attaining this goal has become long and difficult. Moreover, environmental calamities such as frequent droughts and erratic rainfall have also contributed to a continuous decline of agricultural production. Consequently, self sufficiency could be attained not only through the expansion of the cultivated area and improved farming practices, but also by developing high-yield cultivars and hybrids.

In the region, sorghum is used primarily as an important staple food crop although it is frequently used as raw material for various local beverages. In addition, sorghum is used as animal feed, fuel, mulch, and building material.

The eight countries of Eastern Africa produce about 4 million metric tons of sorghum grain annually in over 6 million hectares. The crop is grown either in monoculture

or, more frequently, in mixture with other cereals (e.g., maize and millet) and/or legumes (e.g, cowpeas and Phaseolus beans). The average sorghum grain yield in the region is between 600 and 800 kg/ha; this contrasts with a world average of about 1,500 kg/ha and the region's agricultural research station yields of 3,000 - 5,000 kg/ha. The largest sorghum hectarage is found in tne Sudan which also has one of the lowest yields (about 500 kg/ha).

Finger millet (Eleucine corocana) is the dominant millet grown in Eastern Africa. It is particularly important in drier areas that are unsuitable for sorghum production. However, it is only in Uganda that millet production (500,000 tons/year) is more important than sorghum production (400,000 tons/year). The total area devoted to millet in Eastern Africa is about 2 million ha. Apart from finger millet, limited production of pearl millet occurs in Uganda and Kenya but the potential for increased production exists in both countries. Millets in eastern Africa are used predominantly for human consumption.

Sorghum and millet production constraints in the region were identified.An intensive exchange of germplasms and related technologies took place among NARS and ICRISAT. The network research priorities and plans were developed and implemented through collaborative research projects conducted by lead centers; regional trials, carried out by NARS in the region at different ecological zones; workshops and short course, problem oriented.

Collaborative Research Activities

Ethiopia and Sudan NARS accepted to provide leadership on striga research. In collaboration with the Institute of Agricultural Research in Ethiopia, 28 striga resistant sorghum genotypes were identified in four hot spot locations in Ethiopia. The seed of these 28 genotypes were increased and were distributed for the participating NARS for further evaluation in the region.

Kenya provides leadership for screening sorghum cultivars to long smut resistance. In collaboration with Kenya Agricultural research Institute (KARI), and ICRISAT, the network was able to identify IS8595 as resistance to long-smut. Several other sorghum genotypes are being evaluated to long-smut resistance at Muguga in Kenya for future regional trials.

In collaboration with national programs in Rwanda and Ethiopia 15 and six resistance lines to Ergot disease were identified respectively. In both countries, it was observed that ergot incidence increased as time interval between inoculation and anthesis increased.Screening sorghum cultivars to drought stress was carried out in Wad Medani, Sudan, as lead center of the network. Similar drought resistant sorghum cultivars were also evaluated at Kiboko, Kenya in cooperation with KARI. Few genotypes were included in the preliminary regional observation nurseries in Ethiopia, Sudan, and Kenya.

Table 3. High yielding sorghum varieties released and in pre-released stage by NARS in eastern Africa (1986-1988)

Countries	Sorghum varieties released	Sorghum varieties pre-released stage
Ethiopia	Dinkmash Seredo	IS 158x(ET3235)BC4 RS/R-20-8614-2 X IS 9379 IS 2284
Burundi		Tegemeo Gambella
Rwanda	Amasugi 5Dx160	1804 BM 33 Kigufi Nyirakabuye
Uganda	ET 225 HT Red 2 KX 17/B/1	3 KX 73/1
Kenya	IS 76	IS 8527 IS 8293 KAT 369
Tanzania	Tegemeo	
Sudan		P 967083 Cross 35-5

Source EARSAM reports

Table 4. Millets varieties released and proposed for release by NARS in eastern Africa (1986 - 1988)

Country	Pearl Millet	Finger Millet
Sudan	Bristled Pop (PR)*	-
Kenya	KAT PM 1 (PR) KAT PM 2 (PR)	KAT FM 1 (PR)
Tanzania	SADDC/Tanz-late Composite (PR)	-
Ethiopia	-	FM 3 (PR)
Uganda	-	P 224 (R)** P 277 (PR) U-10 (PR) Seredo x 10 (PR)

* (PR) Proposed for release
** (R) Released

Source - EARSAM reports

4. THE WEST AND CENTRAL AFRICAN COWPEA RESEARCH NETWORK (RENACO)

Largely in West African Semi-Arid tropics (WASAT), cowpea is an important grain legume. It provides protein supplement (approximately 50% of the daily quality protein requirements) to cereals and root crops diets for millions of people in the region. The IITA/SAFGRAD Collaborative cowpea improvement program did facilitate the development and exchange of suitable varieties and related improved agronomic practices.

The West and Central African Cowpea network (RENACO) evolved from cooperative regional trials to a collaborative research network since March 1987. Then, at the general workshop cowpea researchers made thorough inventory of the common production constraints.The strengths, weakness and the coopearative advantage of each NARS was assessed. The relatively stronger national research programs accepted to serve lead centers to enhance the generation of technology.

Collaborative research activities at following lead NARS have identified cowpea cultivars resistant to various stress factors. From Burkina Faso, six striga resistant lines were identified (KV 396-11-6G, KVX 396-8-5G, KVX 396-6-1G, KVX 396-4-4-2, and KVX 396-4-4-4). Six lines were found also resistant to aphids (IT86D-1057, IT835-172-2, IT843-2246-4, KVX 145-27-6, KVX-146-27-4 and KVX 165-14-1). Two bruchid resistant (KVX 30 - G467-5-10K and KVX 30-G183-3-5K) and four lines resistant to multiple disease (IT86D-1056, IT83D-219), and two brown blotch resistant varieties (IT85D-3577, and IT82E-32) were identified. From Senegal IS86-275 was observed to combine resistance to bruchids, virus and bacterial blight.

From Niger, three other striga resistant varieties (TN-5-78, TN-93-80, and TN121-8) were identified.

From ICRISAT Sahelian Center, the IITA program has identified three extra early cowpea lines (IT86D-715, IT86D-719, and IT83D-219).

The new technologies identified at the lead NARS and from ITTA have enabled the network to organize regional trials in various aspects of cowpea improvement and production. Adaptation trials for Sudano-Sahelian zone, Northern Guinea Savanna zones and moist savanna zones were set in motion. Other regional trials are screening for aphids, bruchid, striga and virus diseases reactions.

During SAFGRAD Phase II, the network has made the following contributions to technology exchange and development in the sub-region :

i. Greater interaction among NARS scientists

ii. Exchange of genetic materials among member states and nomination of varieties into the regional trials by the lead centers - Senegal (2 varieties), Nigeria (2 varieties), Niger (2 varieties) and Burkina Faso (3 varieties).

iii. The minimum spray technique developed by the network has resulted in the reduction of chemical sprays required for protection of cowpea against insect damage from 4-7 to 2 without substantial yield decrease.

iv. Identification of two tolerant and six striga resistant lines within the Sub-region.

ADOPTION OF RESEARCH RESULTS BY FARMERS

Through the activities of the network, the following cowpea varieties are presently being cultivated by farmers in member countries.

Guinea Bissau	- IT82E-9
Ghana	- IT82E-16 and IT82E-22
Mali	- Suvita 2
Nigeria	- TVx 3236
Benin	- TVx 1850-01F, IT82E-32, IT81D-1137
Cameroon	- IT81D-985 (BRI) and IT81D-994
Togo	- IT81D-985 (B-Topo)

On-farm survey is needed, however, to quantify on the actual hectarage cultivated to the aforementioned varieties in each country.

II. TRAINING

The network related training program is to develop both scientific leadership and research capabilities. An inventory of the research manpower situation was made in different NARS as indicated in tables... It is evident that networks face an acute shortage of qualified researchers in terms of level of training and disciplines. Development of NARS leadership thus depends on the availability of qualified research manpower. The common constraints to strengthen collaborative research activities of networks is lack of qualified researchers. Both short-term and long-term training plan need to be completed for the networks.

In the past, NARS universities and related institutions have been least involved in training agricultural researchers. The IARCs have provided various types of short-term technician training in agriculture and limited support of degree-level training. To make training relevant to environmental and institutional conditions of the sub-region :

- Advanced research level training M.Sc. and Ph.D could be arranged in selected African universities in close collaboration (if necessary) with developed country universities which have long-term experience in international agriculture.

- Degree level training can also be arranged in cooperation with African universities and IARCs.

- Training at NARS institutions (in-country training) is being conducted by respective networks in order to improve their research training capabilities.

A review of the research manpower of different NARS showed that networks (maize, sorghum, millet, cowpea and FSR) face an acute shortage of qualified researchers. Development of leadership thus depends on the availability of research manpower with corresponding experience. Leadership qualities of NARS scientists have steadily evolved. First, the self-confidence and high sense of responsibility asserted in the management of networks; secondly; the utilization of senior NARS scientists and members of steering committees to assist in implementing network research plans in different NARS; thirdly, the policy and management guidance provided by NARS directors and members of Oversight Committee are good indicators.

Trends of Research Manpower of SAFGRAD Networks is indicated below :

Review of the networks revealed an acute shortage of qualified researchers. The situation of research manpower in the 17 participating NARS is as follows (to be quantified at a later date) :

West and Central African Research network	Current situation of research manpower in the different NARS		
	Weak	Medium	Strong
Maize	14 countries	Ghana, Cameroon	Nigeria
Sorghum	13 countries	Cameroon, Ghana	Nigeria, Mali Burkina Faso
Cowpea	8 countries	Benin, Ghana Mali, Niger Ghana, Cameroon	Nigeria Burkina Senegal
FSR	11 countries	Niger, Burkina Ghana	Nigeria, Senegal Mali

Training workshops and inservice-training.

1. The West and Central African Maize Network

   a. In-service training on maize research took place from 20 June to 29 November 1988 for six trainees from Benin Burkina Faso, Central African Republic, Guinea Conakry, Mali and Tchad.

   b. In-service training on maize research techniques was offered from 18 June to November 1989 for three participants from Ghana, Guinea Bissau and Tchad.

2. West and Central African Sorghum Network

   a. Striga Training workshop was held 5-10 October 1987. Twelve participants from Cameroon, Gambia, Mali, Niger, Togo, Kenya, Ghana, Uganda, Nigeria and Sudan benefitted from the training.

   b. Training workshop on Agronomic research and on-farm testing was held from 19-30 September 1989, in Bamako, Mali.The nine participants were from Côte d'Ivoire, Gambia,Ghana, Guinea Bissau, Mauritania, Niger, Nigeria, Senegal and Sierra leone.

3. West and Central African Cowpea networks (RENACO)

   a. Research Seminar on cowpea improvement and production was held from 4-25 November 1988 at IITA, Ibadan, Scientists from lead centers and IITA cowpea researchers participated in the seminar.

   b. Training of National scientists on appropriate technology development and transfer was held from 10-24 September, 1989 in collaboration of INERA the national agricultural Research program of Burkina Faso. Ten participants from seven countries in the region benefited from the training.

4. Eastern Africa regional Sorghum and Millet Research networks

   a. Sorghum and millet Seed production Training Workshop was held 13 to 19 September 1987. Participants from eight EARSAM countries benefitted from the training workshop.

   b. In-service training between 1986-1988 was provided to 38 participants : Burundi (3), Ethiopia (5), Kenya (6) Rwanda (2), Somalia (9), Sudan (7), Tanzania (4), and Uganda (2).

   c. Entomology short course training workshop was held from 20-30 June, 1989 in Kenya. Seventeen technicians from seven EARSAM countries attended the course. Participants came from Burundi (1) Ethiopia (2), Kenya (6), Rwanda (2), Somalia (2) and Uganda (2). Experts from ICRISAT, ICIPE and Muguga (KARI) assisted as lecturers of the technical sessions and in the practical field activites.

d. Pathology short course was held 15-30 September, 1989 at ICRISAT Center, India. Twelve technicians from seven EARSAM countries attended the course. participants were from Somalia (2), Burundi (1), Kenya (2), Sudan (2), Uganda and Tanzania (2). Experts from ICRISAT Center and one scientist from Nairobi University assisted in the technical lectures and practical activities of the course.

e. In 1989, In-service training for two scientists from kenya on sorghum improvement and diseases was provided through the network.

TRAINING IMPACTS

It is evident that short-courses training workshops, in-service training activities for technicians as well as special workshops and seminars organized by networks has enabled scientists to broaden their research methodologies and approaches on the various aspects of the improvement of food grain (i.e drought, striga, insects and disease resistance etc). Such efforts have also started to yield positive results from feed-back received of the performance of the trainees.

Table 5. SORGHUM NETWORK RESEARCH PERSONNEL (1989/90) IN WEST AND CENTRAL AFRICA*

Country	Breeder			Agronomist			Entomologist			Pathologist		
	MSC	BSC	PhD	MSC	BSC	PhD	MSC	BSC	PhD	MSC	BSC	PhD
Benin		1BSC			1BSC	1		1BSC			2BSC	
Burkina		1BSC	1			1 (+2)			1		1MSC	
Cameroon	1MSC (+1)			1MSC(+)		-		1BSC (+1)		(+1)		
Cape verde		-	-	1MSC								
Mauritania					1BSC							
Cent.Af.Rep.	NA	NA	NA	NA		NA	NA		NA	NA		NA
Cote d'Ivoire				1MSC								
Ghana		BSC 1 (+1) 1MSC										
G. Conakry		-	-		2BSC	(1)						
G. Bissau					2BSC							
Gambia		-	-	1MSC								
Mali	3MSC 1BSC											
Nigeria	1MSC		1	3MSC		2			1	1MSC		1
Niger		1MSC (+1)			2MSC			1MSC (+1)		1(+1)	2MSC	
Senegal												
Tchad			1		2BSC 2MSC			2BSC			1MSC	
Togo				1MSC								

*The number of researchers indicated for each country do not include expatriate staff.

Figure in parethesis indicate researchers in training abroad

NA - information not available

Source - WCASRN reports

Table 6. *COWPEA NETWORK RESEARCH PERSONNEL IN WEST AND CENTRAL AFRICA

Country	Breeder		Agronomist		Entomologist		Pathologist	
	MSC	PhD	MSC	PhD	MSC	PhD	MSC	PhD
Benin (4)	-	1	2	-	1	-	-	-
Burkina (7)	1 BSC (1)		1BSC	1	-	2	-	2
C.d'Ivoire (1)	-	-	1BSC	-	-	-	-	-
Cameroon (3)	-	-	1BSC		1	1	-	-
Ghana (11)	3BSC 1MSC	1	1BSC	-	2	2	1	1
Gambia (1)	-	-	1MSC		-	-	-	-
G. Bissau (1)	-	-	1		-	-	-	-
G. Conakry (5)	1BSC		1BSC		1BSC	1	1BSC	
Cape verde (2)			1BSC		1BSC			
Mali (9)	1MSC 3BSC		1MSC 6BSC		-	-	1	1
Mauritania (1)	1BSC							
Niger (8)	1MSC		2BSC		2BSC	1	1BSC	1
Nigeria (8)	1MSC	-	1MSC	2	1BSC	1	1BSC	1
Senegal (5)	1MSC		(1)	1		1		1
Tchad (1)			1 MSC					

* The above statistics do not include expatriate staff

Figures in parenthesis indicate researchers on study leave.

Source - RENACO reports

Table 7. Maize Network Research personnel (1989/90) in West and Central Africa

	Breeder		Agronomist		Entomologist		Pathologist		TOTAL
	MSC.	PhD	MSC.	PhD	MSC.	PhD	MSC.	PhD	
Country									
Benin	-	-	1	-	-	1	-	-	2
Burkina	1	-	-	-	-	-	-	-	1
Cape V.	-	-	1	-	-	-	-	-	1
C.A.Rep	-	-	-	-	-	-	-	-	-
Cote Iv.	-	1	1	-	-	-	-	-	2
Ghana	-	3	5	1	-	1	-	-	10
GConakry	-	-	5	1	-	1	-	-	7
GBissau	-	-	-	-	-	-	-	-	-
Gambia	1	-	1	-	-	-	-	-	2
Mali	-	-	1	-	-	-	-	-	1
Nigeria	-	2	7	5	1	2	3	-	20
Cameroon	2	1	4	2	2	-	2	-	13
Chad	-	-	-		-	-	-	-	1
Senegal	1	-	1	1	-	-	-	-	3
Togo	-	1	1	-	-	1	-	1	4

*Above statistics do not include expatriate researchers.

Source - WCAMN reports

Table 8. Current level of manpower in EARSAM (Revised Oct. 1989)

Country	PhD		MSc		BSc		Total
	Sorghum	(Millets)	(Sor.)	(Mill)	(Sor.)	(Mill.)	
Burundi	0	NI	0	NI	1(B)	NI	1
Ethiopia	1(B)	0	1(A) 2(P) 1(B)*	0	4(B) 1(A) 1(E) 1(U)*	0	12
Kenya	0	0	1(B)* 2(P)*	1(B)	3(B)* 1(A)	1(B) 1(G)	10
Rwanda	0	NI	2(P)	NI	1(B)	NI	3
Somalia	0	NI	3(B) 1(FS) 3(A) 1(S) 1(E)*	NI	2(B) 3(E)** NI 2(A) 1(P)* 1(S)		18
Sudan	2(B) 1(A) 3(P) 3(U) 1(E)	1(B)	0	0	1(B) 2(P)	0	14
Tanzania	1(A) 1(P)	0	1(B)* 1(E)*	0	1(B)* 1(E)* 1(P)*	1(B)	8
Uganda	0	0	1(A)1(B)* 1(U) 1(P)* 1(G)	1(B)	1(B) 1(E)	1(B)	8
Total	13	1	24	2	30	4	74

Note: * on training
(G) Germplasm
(B) Breeder
(A) Agronomist

** one on training
(E) Entomologist
(U) Utilization
(P) Pathologist

(FS) Farming system NI - Not required
(S) Soils

Source - EARSAM reports

Table . 9. Current and required manpower in eastern Africa (1991 to 1995)

	Current levels			Additional required	
Country	(PhD)	(MSc)	(BSc)	(PhD)	(MSc)
Burundi	0	0	1	1	1
Ethiopia	1	4	7	3	5
Kenya	0	4	6	2	5
Rwanda	0	2	1	1	1
Somalia	0	9	9	7	4
Sudan	11	0	3	5	5
Tanzania	2	2	4	2	5
Uganda	0	5	3	3	3
Total	14	26	34	24	29

Source - EARSAM reports

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AU-SAFGRAD

AU-SAFGRAD